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Monografikoa:
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WOOD CHARCOAL ANALYSIS OF MESOLITHIC ARCHAEOLOGICAL CONTEXTS FROM PORTUGAL: STATE OF THE ART

Análisis antracológico de contextos arqueológicos mesolíticos de Portugal: estado de la cuestión

Antrakologia analisiak Portugaleko Mesolitikoko testuinguru arkeologikotan: egungo egoera

Patricia Diogo Monteiro (*)

Summary:

This paper presents the state of the art of wood charcoal analyses carried out from six Mesolithic archaeological sites in Portugal. Summarized data allows observing the presence or absence of wood species in some Mesolithic Portuguese settlements. Data from six sites are here synthesized. Pine wood is clearly the most frequent taxa in almost all archaeological contexts. Quercus wood is also important, especially in Buraca Grande, Povoado da Gaspeia and S. Julião. Other minor taxa appear in Cabeço da Amoreira, Buraca Grande and S. Julião, but with more representation in the latter.

Key words:

Wood charcoal analysis; Mesolithic; Palaeoecology; Portugal.

Resumen:

Este artículo presenta un estado de la cuestión de los análisis antracológicos y los resultados y principales problemáticas en contextos arqueológicos del Mesolítico en Portugal. El resumen de los datos permite, a través de los estudios antracológicos, observar la presencia o ausencia de especies leñosas en los contextos mesolíticos portugueses. Datos de seis yacimientos son aquí presentados. El pino es claramente el taxa más frecuente en casi todos los contextos arqueológicos. Quercus es el segundo taxón más importante sobre todo en Buraca Grande, Povoado da Gaspeia y S. Julião. Otros taxa menos frecuentes aparecen en Cabeço da Amoreira, Buraca Grande y S. Julião, con más representación en los dos últimos.

Palabras clave:

Antracología; Mesolítico; Paleoecología; Portugal.

Laburpena:

Artikulu honek Portugaleko garai Mesolitikoaren testuinguru arkeologikoetan egindako analisi antrakologien egoera aurkezten du eta hauek dituzten emaitzak eta arazo nagusiak ere. Ikerketa antrakologikoek emandako datuen laburpenaren bidez, Portugaleko testuinguru Mesolitikoen zurezko landareen agerpena edo gabezia ikusi daiteke. Sei aztarnategiko datuak aurkezten dira hemen. Pi-

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nua taxa ohikoena da argi eta garbi ia testuinguru arkeologiko guztietan. Quercus ere garrantzitsua da, batez ere Buraca Grande-n, Povoado da Gaspeia-n eta S. Julião-n. Hain ohikoak ez diren beste taxa batzuk ere agertzen dira Cabeço da Amoreira-n, Buraca Grande-n eta S. Julião-n; azken bi hauetan adierazpen handiagoarekin.

Hitz Gakoak:
Antrakologia; Mesolitikoa; Paleoekologia; Portugal.

1. Introduction

The analysis of archaeological wood charcoal is an important tool to assess palaeocological questions and to understand the human use of woodland resources in the past. In the case of prehistoric hunter-gatherer societies, this subject is particularly important, since the management of wild vegetal resources must have been an important part of the economy of these populations. The importance of gathering resources have been usually underestimated by researchers, mostly because of the lack of archaeological visibility of plant macro remains. This invisibility of plant remains was usually associated with conservation issues of these materials. Anyway, this tends to happen more with carpological material than with charcoal, once this usually recovered. Otherwise, faunal remains, more abundant and visible on archaeological record, gave always a predominant role to hunting activities in the economy. (ZAPATA, 2000, 2007).

This idea of no preservation and inexistence of plant macro remains was put aside by the arrival of new methodologies of data recovery as well as the growing importance of disciplines that study these remains that were proving their potential (VERNET, 1997). The flotation of sediments, the advised method for systematic recovery of plant macro remains (ALONSO et al, 2000), proved that it is possible to recover successfully these type of remains and that their conservation was not a problematic factor (BADAL, et al, 2000; ZAPATA, 2007).

Charcoal analysis shows an earlier development than the study of other plant macroremains in Portugal, and that fact may be related to recovery methods; charcoal is more visible during the excavation process and sometimes can be recovered without flotation.

The identification of wood charcoal as well the use of microscopy allowed the development of the discipline, with Jean Louis Vernet as one of the main contributor (VERNET, 1997). The observation of charcoal on three main sections: transversal, longitudinal tangential and longitudinal radial allowed the identification of wood anatomy structure, preserved by carbonization.

In Portugal, charcoal analyses have a recent development. The first studies focused on defining some species as native in our territory, such as *Pinus pinaster, Pinus tp. sylvestris* and *Olea europeae*, proving their antiquity and presence in the Pleistocene forests. A summary of these studies has been presented in Figueiral (1995) and Figueiral and Terral (2002).

The growing perception of the importance of palaeoenvironmental studies for understanding archaeological contexts lead to an increase of charcoal analyses studies since the 90's decade. The work of Isabel Figueiral, Paula Queiroz and José Mateus was remarkably important, and started the inclusion of charcoal analysis in archaeological research (e.g., FIGUEIRAL, 1993, 1995, 1996, 1998; FIGUEIRAL and TERRAL, 2002; FIGUEIRAL and SANCHES, 2003; FIGUEIRAL and CARCAILLET, 2005; QUEIROZ and MATEUS, 1999; QUEIROZ et al, 2002, 2003).

Nowadays, the application of archaeobotanical methods in archaeological excavations is rising, but the majority of published studies are focused on Later Prehistory, Protohistory and Roman contexts (see, among others, VERNET, 1986; BADAL, 1987; FIGUEIRAL, 1993, 1995, 1996; FIGUEIRAL and SANCHES, 2003; DUQUE ESPINO, 2005; TERESO, 2007). However, some studies have been made in Mesolithic contexts and their data and results are presented here.

2. Charcoal analysis from Portuguese Mesolithic contexts

During the Mesolithic archaeological remains in these settlements attested a growing social complexity. The transition to the Holocene had an important impact in the landscapes. The rise of sea level transformed the littoral areas into estuarine basins, which provided an increase of biomass and marine, fluvial and terrestrial resources. Muge and Sado shellmiddens are the most studied cases for dietary isotopes of populations, and the results show that marine and terrestrial resources had similar importance on human diet, proving the exploitation of different environments (LUBELL et al, 1994; BICHO et al, 2010; UMBELINO, 2006). The human adaptation to these environmental conditions is also reflected in the gathering and selection of wood. Table 1 summarizes the *taxa* identified on charcoal analyses carried out on Mesolithic archaeological contexts in Portugal. This table aims to be a compilation of information and a tool to compare the different species occurrence in each site. A further issue would be to consider the specificities of each settlement and the occurrence of charcoal within it. Some cases will be discussed with more detail to exemplify and assure charcoal occurrence and specific problematic. Here only will be presented with more detail archaeological Mesolithic contexts where charcoal analyses have been carried out and published. Other sites that mention some charcoal analyses in the scope of the incidence of some specific *taxon* (e. g. *Pinus* tp. *sylvestris*) (FIGUEIRAL and TERRAL, 2002) will be mention further in discussion. In spite of the limitations, it is hoped that taken together, data would offer a general view of woodland exploitation in Mesolithic Portuguese sites.

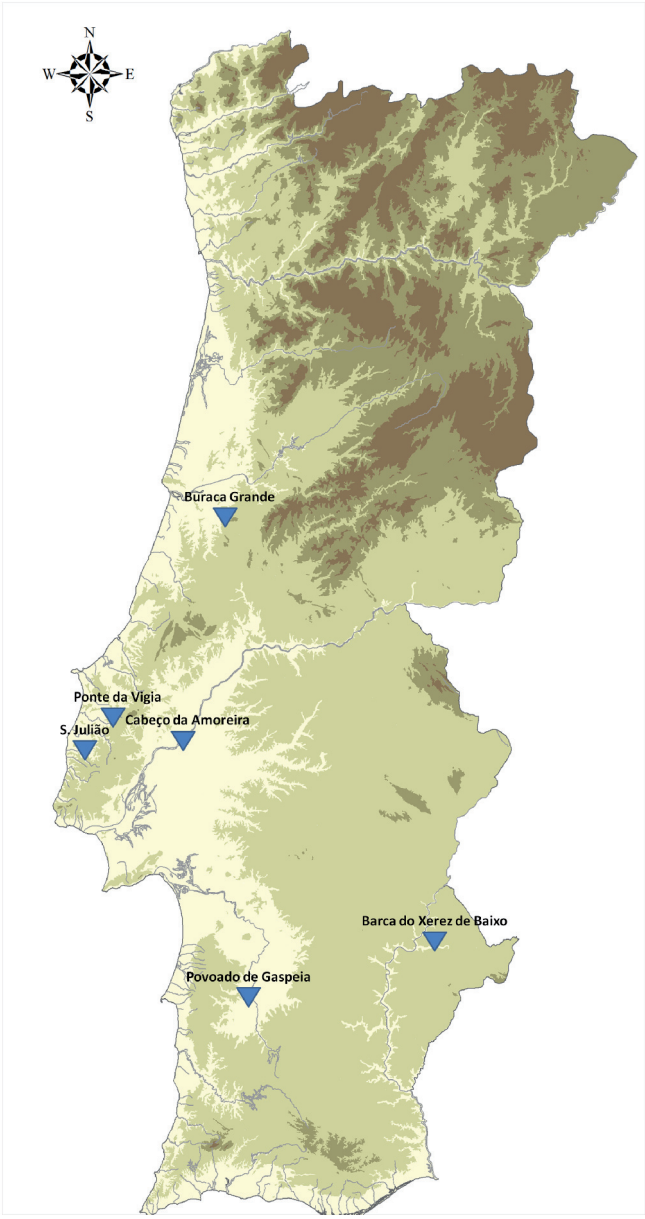

Figure 1. Localization of Mesolithic archaeological settlements with wood charcoal studies discussed in the text.

2.1. Cabeço da Amoreira (Muge shellmiddens)

Cabeço da Amoreira is a settlement that integrates the Muge shellmiddens complex, near Tagus Valley, Santarém, 60 km from Lisbon (Figure 1). The chronology ranges for the site between 6232 and 6018 BC. The site has been excavated for several teams since 1863, upon its discovery. Different moments of occupation have been identified in Cabeço da Amoreira: a residential occupation, shellmidden and burial deposits (BICHO et al, 2010, 2011).

Charcoal analyses have been carried out for the following contexts: profiles, hearth, pit, burials and scattered charcoal from shellmidden layers. Over 2500 charcoal fragments have been analysed. *Pinus* cf. *pinaster*, *Pinus* cf. *pinaster/pinea, Pinus* tp. *sylvestris, Pinus* sp., *Quercus* (evergreen), *Quercus* (deciduous), *Quercus* sp*., Arbutus unedo* and *Pistacia lentiscus*, indeterminate gymnosperms and angiosperms were identified in Cabeço da Amoreira contexts (WOLLSTONECROFT et al, 2006; MONTEIRO, 2012; MONTEIRO et al, 2012, and unpublished data).

The results show a clear predominance of pine and conifer wood in every context. *Quercus* wood is also present in all context but in a low percentage. *Arbutus unedo* and *Pistacia lentiscus* appear in a low number of fragments, being only relevant to certify that those species were burnt on the site. The interpretation of these data concerning the use of fire within the settlement is still under study. So far, charcoal analyses show some agreement with pollen analyses. The pollen diagram from Muge valley (SCHRIEK et al, 2008) shows an open landscape with several scrub species that were not identified in charcoal analyses. We should consider as logical the differences we may find when crossing charcoal and pollen data, due to the different regional/ local input of *taxa*, taphonomic and conservation issues and human preferences.

2.2. S. Julião

S. Julião is a shellmidden situated in Mafra, Portuguese Estremadura (Map 1), dated from 7452 to 6713 BC (Sac. 1721). The analysed assemblage provides from combustion structures identified in the shellmidden area São Julião C (SOUSA and MIRANDA, 2001; VAN LEEUWAARDEN and QUEIROZ, 2004). The results are based on the analysis of 526 charcoal fragments. The following *taxa* were identified (more frequent to less frequent): *Pinus pinaster, Quercus* (evergreen), *Arbutus unedo, Olea europeae, Erica arborea, Quercus* (deciduous), *Quercus* sp*., Ulex* sp*., Daphne gnidium, Fraxinus, Erica* sp*., Erica* cf. *umbellata*, *Juniperus, Populus*, Leguminosae, Rosaceae Maloideae, cf. *Crataegus monogyna*, *Cistus* tp*. C. albidus*, Ononis tp., *Pinus* tp. *sylvestris, Pinus sp.*. A palaeoecological interpretation is made in this study, trying a reconstruction of the surrounding landscape, available resources and spread and disappearance of species during this climatic period (VAN LEEUWAARDEN and QUEIROZ, 2004). The presence of thermophilous species is clear, although some resilience of species of colder environment is also noted. The large range of *taxa* identified might happen because of the large number of charcoal observed.

2.3. Ponte da Vigia

Ponte da Vigia is a Mesolithic settlement located in Torres Vedras, Portuguese Estremadura (Map 1). The site chronology is 8250 to 7680 BC, from charcoal samples (ZAMBUJO and LOURENÇO, 2002). In the scope of the archaeobotanical and palaeoecological investigation program, charcoal analyses were made in Ponte da Vigia (VAN LEEUWAARDEN and QUEIROZ, 2000).). All recovered charcoal comes from hearts. Ninety six charcoal fragments were randomly selected from the samples for microscope observation. The following *taxa* were identified: *Pinus pinaster* and *Pinus* sp. It was concluded that this kind of wood

was used for fuel on the settlement and that these results match with the known landscape for the beginning of Holocene (VAN LEEUWAARDEN and QUEIROZ, 2000).

2.4. Povoado de Gaspeia

Povoado de Gaspeia is a Mesolithic and Neolithic settlement located in Santiago do Cacém (South Portugal) (Map 1), dated from 7452 to 6713 BC (SILVA, 2005). Charcoal identified has been recovered from combustion structures and published in an archaeobotanical report (TERESO and QUEIROZ, 2006). The following *taxa* were identified (90 fragments): *Pinus pinaster, Pinus pinea, Pinus* sp*., Quercus* (evergreen), *Quercus* sp. The denomination of some identified *taxa*, *Quercus* (evergreen) was suggested for review in communication by one of the author (Tereso). These *taxa* appear in all the combustion structures. There is only a difference in one of them that might not be a combustion structure, but a refuse deposit (Silva, 2005). Even so, it could be considered a secondary deposition of charcoal. This structure presents a higher representation of *Quercus* (evergreen). The low number of fragments recovered did not allow further considerations about the representation of each *taxa* within each context (TERESO and QUEIROZ, 2006).

2.5. Buraca Grande

Buraca Grande is a cave located in Estremadura (central Portugal) (Map 1) (AUBRY et al., 1997). The fieldwork lead by Aubry and Moura revealed a sequence from the Upper Palaeolithic to Late Neolithic. Charcoal analyses have been carried out from all the layers that correspond to the different occupation phases. Different palaeoecological phases were also identified based on the presence/absence of *taxa* (FIGUEIRAL and TERRAL, 2002). Layer 8C (7452 to 6713 BC, Gif-9679) corresponds to the Mesolithic occupation. A total of 303 charcoal fragments were analysed. The following species were identified from the most frequent to less frequent: *Olea europaea, Quercus* (evergreen), *Arbutus unedo, Pistacia lentiscus, Rhamnus/Phillyrea, Quercus* (deciduous), *Buxus sempervirens, Pinus* cf. *pinaster,* Leguminosae, Rosaceae Pomoideae.

The results show a predominance of mainly Mediterranean taxa, being *Olea europeae* the most frequent species (FIGUEIRAL and TERRAL, 2002). Measuring analyses were made on *Olea europeae* fragments. They were statistically tested in terms of vessel density and conductance, giving approximate information about temperature and precipitations (TERRAL and MENGUAL, 1999).

The presence of thermophilous *taxa* from the Upper Palaeolithic in Buraca Grande and Estremadura region is known by charcoal and pollen analyses (FIGUEIRAL, 2000). Although, the presence of thermophilous *taxa* is attested in previous occupation/climatic phases, the Holocene layers (8C) have a clear predominance of Mediterranean species (FIGUEIRAL and TERRAL, 2002). The differences between phases are not only noted by the presence/absence of species. The information about temperature and precipitation and climatic conditions given by vessel density and conductance analyses have shown a significant increase of temperature, that agrees with the development of thermophilous forest (FIGUEIRAL and TERRAL, 2002).

2.6. Barca do Xerez de Baixo

Barca do Xerez de Baixo is a settlement located in Alentejo, South Portugal (Map 1). Charcoal fragments have been identified for this site for datation; and there is no information about the number of charcoal recovered. It is known that this charcoal had a primary origin, since it was recovered from combustion structures (ARAÚJO

and ALMEIDA, 2013). The following species were identified: *Quercus ilex/Q. coccifera* and *Erica arborea*. The dates vary between 7941-7604 cal BC (structure A) to 7312-7059 cal BC (structure E). In structure A both species were discovered and dated, and from structure E only charcoal from *Erica arborea* was dated. Without further information about charcoal recovery and analyses it is not possible to achieve other conclusions than these have been used for fuel in the settlement.

3. Discussion

Studies were made including charcoal analyses from other sites. *Pinus* tp. *sylvestris* and *Pinus pinaster* presence in Portuguese archaeological contexts have been studied before, trying to attest the presence, resilience and origin of these species in Portuguese territory and theirs archaeological incidence (FIGUEIRAL, 1995; FIGUEIRAL and TERRAL, 2005). In those studies, some sites as Chã das Lameiras and Areeiro III have also showed the presence of these *taxa* in Mesolithic horizons.

The presence of almost the same *taxa* (*Pinus pinaster, Pinus pinea, Pinus* tp*. sylvestris, Quercus* - both evergreen and deciduous) in every archaeological site summarized here should be noted. This might suggest some preference for both kinds of wood, as well as their availability in the surrounding landscapes. The presence of these species in the surrounding landscapes could be confirmed by pollen diagrams for several regions in Portugal, that attested the availability of pine and oak wood for exploitation (SCHRIEK et al, 2008; MATEUS and QUEIROZ, 1993, 2000). Some slight differences in the assemblages are observed too. In Cabeço da Amoreira, *Pinus* tp. *sylvestris* is more frequent than in other Mesolithic contexts, where *Pinus pinaster* is usually the most abundant. The appearance of some minor *taxa* such as *Arbutus unedo* and *Pistacia lentiscus* is posibly related with the sample size, once larger is the sample the probability of appearing less frequent *taxa* increases. All other contexts show an important presence of Mediterranean pines in comparison to other kind of pine such as *Pinus* tp. *sylvestris*, that is less frequent or absent.

One should exercise some caution when observing the data here presented. The differences among sites must be considered when comparing these data. As the summary of each site shows, there are clearly different contexts, sampling processes as well as different methodologies. The number of charcoal fragments analysed may also condition the interpretations -in some sites a considerable amount of charcoal has been recovered and identified whereas in others very few has been analysed. This offers a problem to use statistic tools and also to asses species representation and human choices on wood selection in the site. Some comparisons may be done, but it is important to notice that we are dealing with assemblages with different characteristics. For example, in the Barca do Xerez de Baixo case, only a few fragments were identified for datation, and therefore, it is not possible to achieve further interpretation once it is not possible to know if only two *taxa* were identified because were the only ones present or if it is due to the small sample. As we see from other examples, like Cabeço da Amoreira, S. Julião and Buraca Grande, where over 300 charcoal fragments have been analysed, the number of identified *taxa* increases significantly. A higher number of fragments analysed favours the appearance of more *taxa*, as we can see by these assemblages.

Another important question focuses on the origin of charcoal at each site: some of the fragments were retrieved from well delimitated structures, hearths or other types, and some others were recovered scattered in the sediment. In most cases, the charcoal provided by hearths or combustion structures (S. Julião, Ponte da Vigia, Povoado da Gaspeia and Barca do Xerez de

Baixo) are the ones with less charcoal fragments (less than 200 analysed in most cases), with the only exception of S. Julião. This might be because these are delimitated areas that have been sampled, and so, the amount of charcoal recovered tends to be smaller. But in some cases, as we have referred before, it is due to the fact that some of these samples are not charcoal recovered systematically; only a few have been recovered for datation and identification. Thus, some assemblages are more suitable than other for paleoethnobotanical or paleoenvironemntal interpretations.

Even so, it is possible to observe in these studies vegetation and climatic changes in the Holocene; a more humid and temperate climate led to the expansion of oak forests and other thermophilous species in our territory. *Quercus* (evergreen), *Quercus* (deciduous), *Arbutus unedo*, *Erica arborea*, *Pistacia lentiscus* and *Pinus pinaster* are some examples o*f these* thermophilous taxa exploited during Mesolithic in Cabeço da Amoreira, S. Julião, Ponte da Vigia, Povoado da Gaspeia e Buraca Grande. These studies reveal the contribution of charcoal analyses for paleoecological reconstructions, as it is the case of Buraca Grande (Figueiral and Terral, 2002). The majority of sites from the Portuguese Mesolithic present a larger representation of thermophilous *taxa*: *Pinus pinaster, Pinus pinea, Quercus* (evergreen), *Quercus* (deciduous), *Arbutus unedo, Erica arborea, Pistacia lentiscus.* Although it is not advised to use charcoal analysis on its own for palaeoecological reconstruction, these data are consistent with pollen analyses and so, they confirm Holocene climatic changes (MATEUS and QUEIROZ, 1993, 2000).

Some species, such as *Pinus* tp. *sylvestris*, which is related with colder environments, are present along Pleistocene and Holocene in different regions which may confirm the prevalence of some species during transition periods and the presence of refuge zones in Iberian Peninsula (FIGUEIRAL and CARCAILLET, 2005). Although *Pinus* tp. *sylvestris* might be related with colder climatic conditions due to its adaptation and preference for some altitude, *Pinus* tp. *sylvestris* have large distribution in Iberian Peninsula, even in Mediterranean zones (COSTA et al, 2005).

The major problem found in charcoal studies in Portugal for this chronology is the difficulty to compare the results between Mesolithic charcoal assemblages. Even though some problematic with information, in figure 2 it is presented in percentage the main identified species on the presented settlements. Barca do Xerez de Baixo has not been included because the charcoal identified was only punctual and we do not know the number of the total assemblage. As we can see, pine wood, especially cluster pine (*Pinus pinaster*), is the main species in the majority of the sites. However, Buraca Grande and S. Julião present other *taxa*, mostly angiosperms, like *Olea europeae* and *Arbutus unedo*, in relation of pine and oak wood. Even so, the representation of *Pinus pinaster* in S. Julião is also significant, once is the most numerous *taxon*. Only in Povoado da Gaspeia, Cabeço da Amoreira and Buraca Grande charcoal from deciduous and evergreen *Quercus* are the second most representative *taxa*, in the other contexts other angiosperms. In Ponte da Vigia *Quercus* wood is absent, being only represented pine wood. The presence of *Pinus, Quercus* and other *taxa* is noted in Buraca Grande, S. Julião and Cabeço da Amoreira, those whose assemblages have more charcoal fragments observed.

Although it is possible to do some relative comparisons between present *taxa*, some samples are too small to be representative, as it has been discussed previously. Otherwise, in some cases it would not be suitable to compare such different assemblages, 5 charcoal fragments from a combustion structure and 2500 from different contexts. The first might result from a residual activity or short-time activity and the second one

is a sample from a profile, burial areas, scattered charcoal on shellmidden, resulting therefore from specific but also long-term activities. Despite that, other conclusions concerning presence and absence of wood types could be achieved, as well as the kind of wood used for fuel during Mesolithic.

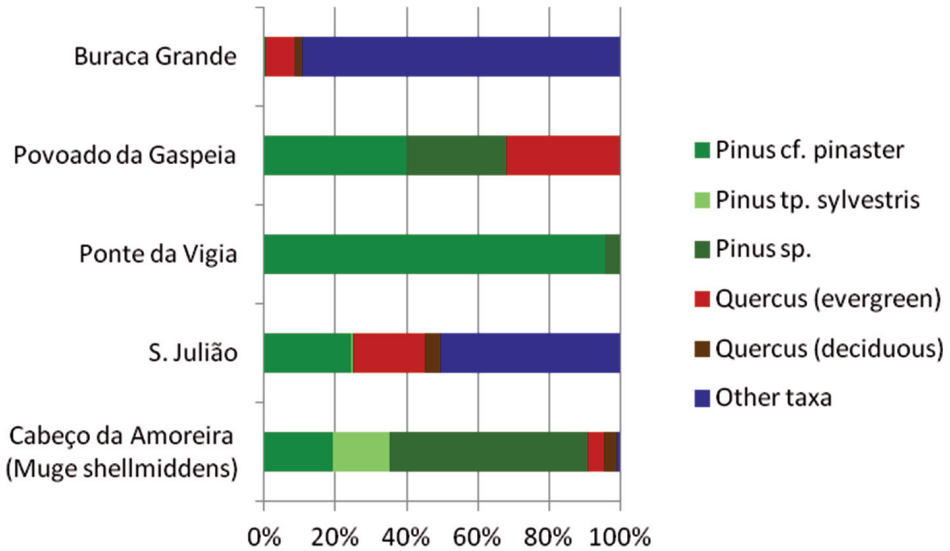

Figure 2. Porcentual results of wood charcoal from Mesolithic Portuguese settlements.

The comparison with pollen analysis is important for interpretations on wood charcoal results. In the case of Muge valley pollen diagram, an open landscape is presented and the most representative species are present in charcoal results too. The presence of some arboreal and shrub species in pollen diagram that are absent in charcoal assemblage might be associated with the local input of charcoal data versus regional input from pollen. In other cases, pollen studies for Estremadura, were most of the settlements are located, show similar results between pollen and charcoal (MATEUS and QUEIROZ, 1993, 2000). This indicates that species that grow on settlement surroundings have been exploited and brought for using as fuel.

The preference for gathering pine wood could be related with the death of pines for Estremadura region (SCHRIEK et al, 2008), since death wood is an available resource easy to gather (MONTEIRO, 2012). Besides in Cabeço da Amoreira case, some fungi were identified on charcoal. Although microbiological contamination might be signal of deadwood or storage resources, it is not possible to prove it, because contamination could happen when the tree was still living (MOSKAL et al, 2010). Pine wood is known by its burning properties and fast combustion (CHABAL, 1997), being that a reason that might lead some might result in its preference and selection.

In contexts where domestic occupations are excavated, the presence of charcoal is usually related to human use of wood for fuel. The use of woodland resources for other purposes is a more difficult question to assess at the moment. In any case, in combination with other *proxies*, wood charcoal may become a very good indicator of human practices and environmental change.

4. Conclusions

Wood charcoal analyses from archaeological contexts from six Mesolithic sites have been summarized. Some samples were retrieved applying archaeobotanical recovery methods such as flotation and other samples recovered charcoal by other methods, by sieving or by hand. Despite those different approaches, a total of at least 3520 charcoal fragments have been

TABLE 1. PRESENCE AND ABSENCE OF TAXA.						
	Buraca Grande (Redinha)	**Cabeço da Amoreira (Muge)**	**Ponte da Viga (Torres Vedras)**	**S. Julião (Mafra)**	**Povoado de Gas-peia**	**Barca do Xerez de Baixo**
Datation (radiocar-bon)	7788-7593 BC	6232-6018 BC	8250-7680 BC	7452-6713 BC	7452-6713 BC	7312-7059 cal BC
Arbutus unedo	X	X	-	X	-	
Buxus sempervirens	X	-	-	-	-	
Cistus sp.	-	-	-	X	-	
Daphne	-	-	-	X	-	
Erica arborea	X	-	-	X	-	X
Fraxinus angustifolia	-	-	-	X	-	
Juniperus		-		X	-	
Leguminosae	X	-	-	X	-	
Olea europaea	X	-	-	X	-	
Pinus pinea		X			X	
Pinus pinaster	X	X	X	X	X	
Pinus tp. sylvestris		X	-	X	-	
Pinus sp.	X	X	-	-	X	
Pistacia lentiscus	X	X	-	-	-	
Populus sp.	-	-	-	X	-	
Prunus sp.	-	-	-	-	-	
***Quercus* (deciduous)**	X	X	-	X	-	
***Quercus* (evergreen)**	X	X	-	X	X	X
Rhammus/phillyrea	X	-	-	-	-	
Rosaceae pomoidea	X	-	-	X	-	
Ulex sp.	-	-	-	X	-	

(X) Present; (-) Absent; None - No information about the taxon.

observed and identified from Mesolithic contexts in Portugal. *Pinus pinaster, Pinus pinea/pinaster*, *Pinus* tp. *sylvestris*, *Pinus* sp.*, Quercus* (evergreen), *Quercus* (deciduous), *Arbutus unedo, Erica arborea, Pistacia lentiscus, Rhamnus/Phillyrea, Buxus sempervirens,* Leguminosae*, Rosaceae Pomoideae, Rosaceae Maloidea,* cf. *Crataegus monogyna, Cistus* tp*. C. albidus, Ononis* tp.*, Ulex* sp.*, Daphne gnidium, Fraxinus, Erica* sp.*, Erica* cf. *umbellata, Juniperus, Populus* are *taxa* identified in these contexts. The majority of wood species from these Mesolithic contexts is thermophilous *taxa*.

Pine wood is clearly the most frequent *taxon* in all archaeological contexts of Portuguese

Mesolithic. The advantages of using this kind of wood for fuel or its availability maybe as dead wood might be reasons involved in its selection. Even so, Pine wood could be the most abundant wood in settlements surroundings.

More charcoal analyses using systematic sampling are needed from Mesolithic sites in Portugal. This would help us improve our questions and interpretations on vegetation change and on human exploitation of woodland resources.

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